

Close-Out Document No. 26

**Marine Corps Base (MCB)
Quantico, VA**



**Engineering Field Activity Chesapeake
Naval Facilities Engineering Command**

January 2003

**QUANTICO CREEK CLOSE-OUT DOCUMENTATION
MARINE CORPS BASE QUANTICO, VIRGINIA**

This document provides the close-out documentation for Quantico Creek adjacent to the U.S. Marine Corps Base in Quantico, Virginia. This document was prepared under Contract No. N47408-01-D-8207.

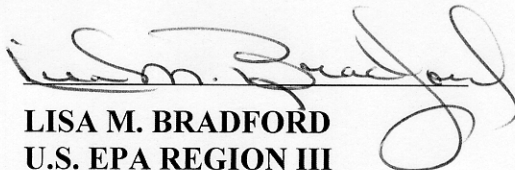
The three primary objectives of the Quantico Creek screening-level risk assessments are: 1) to determine if operations at the Marine Corps Base have resulted in the release of chemical constituents to Quantico Creek; 2) to assess whether concentrations of chemical constituents related to Base activities occur at concentrations that may pose unacceptable risk to humans and ecological receptors; and, 3) to determine whether chemical concentrations present in sediments adjacent to the Base are different from background conditions in Quantico Creek. The risk screening process involved collecting and analyzing sediment samples from areas of Quantico Creek adjacent to the Base to determine if activities at the Base have impacted the adjacent Quantico Creek sediments, and samples from upstream locations near the towns of Dumfries and Triangle representative of background conditions in the creek. Chemical concentrations in creek sediments were compared to conservative risk-based human health and ecological screening benchmarks to arrive at an initial list of constituents of potential concern (COPCs). This list of COPCs was then refined using more realistic and site-specific conditions for Quantico Creek. The receptors, exposure pathways, and screening and refinement criteria are based on the conceptual site model and documented in *Quantico Watershed Study, Quantico Creek Ecological and Human Health Risk Screening Assessment* report (Battelle and Neptune and Company, 2002).

The conclusions documented herein represent the results of the human health and ecological screening risk assessments conducted for Quantico Creek.

We, the undersigned members of the QPMT, have reviewed the information in this document and agree with the conclusions presented.



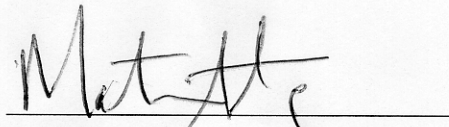
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SITE NAME	SITE DESCRIPTION	CONCEPTUAL SITE MODEL	DATA EVALUATION	CONCLUSION
Quantico Creek	<p>Quantico Creek is a tributary of the Potomac River that bounds approximately 2.8 kilometers of the northern edge of the Mainside portion of the Quantico Marine Corps Base. The creek adjacent to the base is shallow, averaging between 1 and 2 meters in depth over most of its length. Little Creek flows through the Marine Corps Base and empties into Quantico Creek approximately 500 meters upstream of the junction of Quantico Creek with the Potomac River. The tidal portion of Quantico Creek extends approximately 4.1 kilometers upstream, and varies in width from approximately 150 to 900 meters. The tidally influenced section of the creek adjacent to the Base is the focus of this investigation to determine if any activities at the Marine Corps Base have impacted the creek sediments. The western one-quarter of the tidal section of Quantico Creek adjacent to the town of Dumfries is marshy in nature, with abundant emergent wetland vegetation and was considered as a background area for comparison.</p>	<p>No releases of hazardous chemicals from the Base to Quantico Creek have been documented, but several sources along the first 500 meters of shoreline may have contributed chemical constituents to the creek. Four outfalls (PR-80, PR-81, PR-82, PR-83) discharge into Quantico Creek near its confluence with the Potomac River. The outfalls do not have NPDES permits and likely received runoff from roof drains and air conditioning condensate overflows associated with the former base hospital. It is questionable if outfalls PR-80 and PR-83 continue to function, as the last outfall map revision dated August 1975 (1959 original edition) did not indicate a drainage area. Onshore sites that may have impacted Quantico Creek include Site 35, the Building 2208 Accumulation Area; Site 58, a stained patch of ground located approximately 50 yards north-northwest of Building 2208; and Site 14, a construction debris fill area that operated along Little Creek from 1917 to 1920. All of these sites have been closed with No Further Action by the QPMT. Site 98, a golf course maintenance area in the Little Creek watershed is the subject of a DTAWS investigation. Activities that occurred at Site 98 included mixing of pesticides for application to the golf course. Non-base related sources located on Quantico Creek include a CSX railroad bridge, upstream historical mining activities, the town of Dumfries, and the Possum Point Power Plant. The primary transport pathway of chemical constituents from the Base to Quantico Creek is through surface water runoff. Surface water generated at the site will either infiltrate into the underlying substrate or discharge into Little Creek or Quantico Creek via the intermittent stream channels and swales. Once in the creek, the primary redistribution of chemical constituents in sediments is due to resuspension and movement of sediments due to storm conditions. Normal flow velocity is expected to be low, as demonstrated by the overall shallow nature of the creek and the fact that there are no clear channels running through the lower portion of the creek. Although tidal action could transport chemical constituents in an upstream direction, data indicate that significant transport in this direction has not occurred. Chemicals observed in Base sediments (i.e., PAHs, PCBs, DDxs), are expected to remain bound to sediment with little partitioning to the water column due to their relatively insoluble nature and their affinity for organic matter. Food chain transport to upper trophic levels is considered a significant transport pathway for bioaccumulating organic chemical constituents present in Quantico Creek. These COPCs, PCBs, DDxs, and PAHs in particular, are expected to be transferred to humans and upper trophic level ecological receptors through ingestion of food items that have accumulated these constituents from sediments. Concentrations of PCBs, DDxs, and PAHs in fish tissue were estimated by applying sediment to fish bioaccumulation factors recommended by the EPA National Sediment Quality Survey.</p>	<p>Sampling locations - Attachment A. Data Summary Tables – Attachment B.</p> <p>Surface sediment collected from eight Quantico Creek locations adjacent to the Base and eight sampling locations located in Quantico Creek upstream from the Base were submitted for fixed laboratory analyses and rapid analytical analyses. All fixed laboratory samples from Quantico Creek were analyzed for TAL metals, PAHs, PCBs, and pesticides. Surface samples were collected from the top 5 cm to ensure that the sediments represented the biologically active zone.</p> <p>Total PCBs, total DDxs, and six PAH compounds were statistically elevated in Base sediments compared to upstream sediments. Dieldrin, aldrin, and gamma chlordane also appeared higher in Base sediments, although they were not detected frequently enough to conduct statistical comparisons. No metals were significantly different from upstream concentrations, and elevated metals concentrations in the creek appear attributable to upstream mining activities.</p> <p>Human Health: Estimated concentrations of PCBs, DDx, and dieldrin in fish tissue exceeded fish screening RBCs. However, risk values calculated for these constituents showed no incremental risk from estimated levels of these constituents in Base fish compared to estimated levels in upstream fish.</p> <p>Ecological: 4,4-DDx compounds, dieldrin, gamma-chlordane, total PCBs, acenaphthene, and fluorene were identified as posing potential risk to ecological receptors after the ecological screening and COPC refinement process was completed. The magnitude of screening benchmark exceedances is low (only DDx compounds exceed ER-Ms), and was spatially limited to around the mouth of Little Creek. No Base related sources of these constituents to Quantico Creek are evident. (Only 4,4-DDE posed potential risk to upper trophic level receptors, and the magnitude of risk is small (dose < low effects TRV))</p>	<p>Based on the chemical data collected, chemical concentrations observed in Base sediments have limited potential for environmental impact. No incremental risk to human health is posed by chemicals in sediment or fish tissue. Potential risk to ecological receptors is low in magnitude and limited in areal extent. No historical or continuing sources of chemical constituents to Quantico Creek from the Base are evident.</p> <p>Site Status: No Further Action.</p>

ATTACHMENT A.

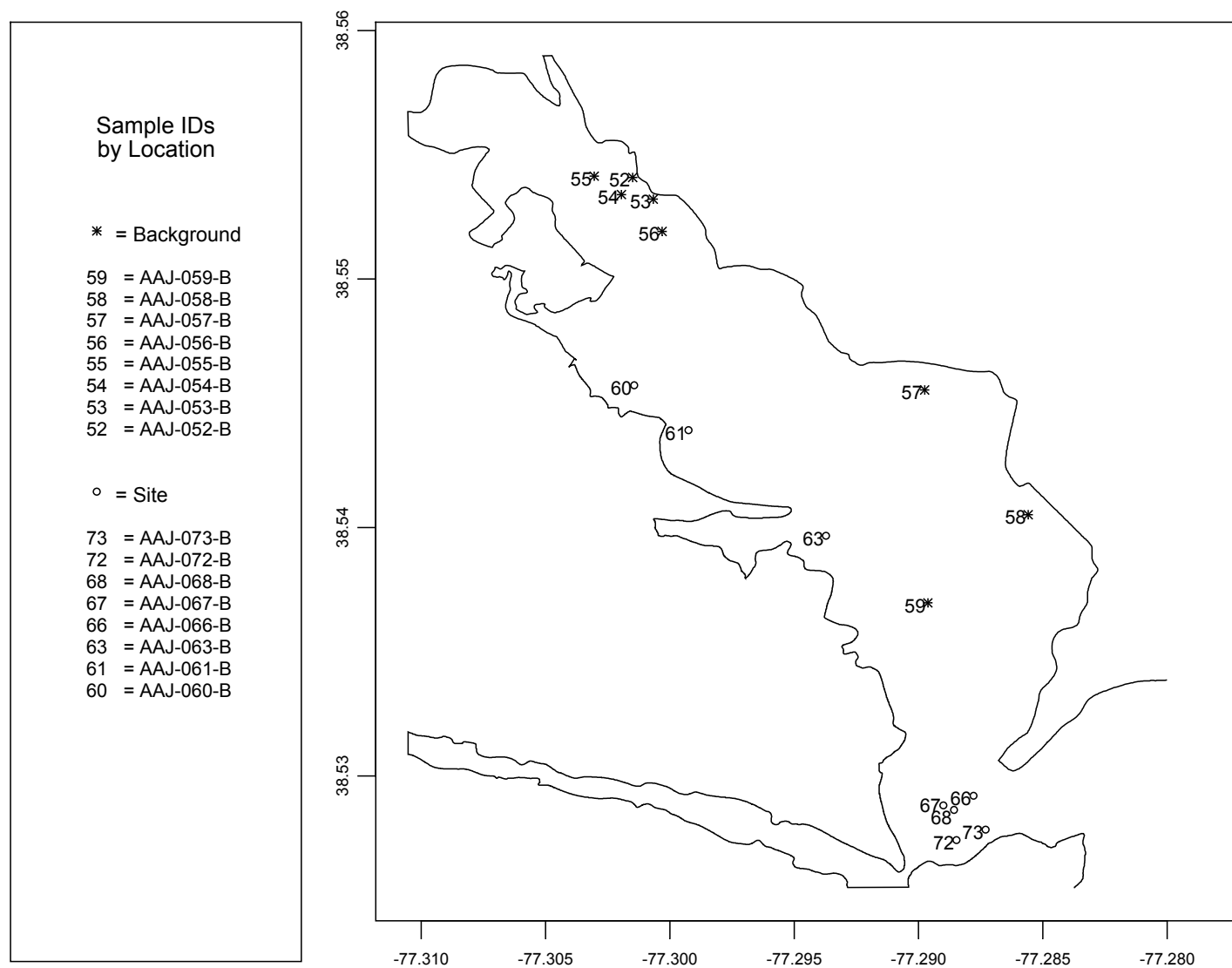


Figure 1. Quantico Creek Sampling Locations

ATTACHMENT B.

Table 1. Summary of Sediment Metal Concentrations.

Analyte	General Area	Area	Nondetects			Detects				
			N	n	DL	n	Min.	Median	Mean	Max.
Aluminum	Quantico Creek	Bckgrd	8	0		8	43300	78650	70750	80800
		MCB	8	0		8	39600	68300	62710	76400
Antimony	Quantico Creek	Bckgrd	8	0		8	0.614	0.9185	0.9825	1.41
		MCB	8	0		8	0.548	0.8815	1.566	6.49
Arsenic	Quantico Creek	Bckgrd	8	0		8	6.54	10.95	10.76	13.9
		MCB	8	0		8	5.41	10.41	9.735	13.2
Barium	Quantico Creek	Bckgrd	8	0		8	558	595.5	596.4	646
		MCB	8	0		8	520	553.5	562	598
Beryllium	Quantico Creek	Bckgrd	8	0		8	1.31	2.735	2.446	2.93
		MCB	8	0		8	1.69	2.405	2.259	2.83
Cadmium	Quantico Creek	Bckgrd	8	0		8	0.739	1.435	1.628	2.75
		MCB	8	0		8	0.456	0.9305	1.221	2.74
Chromium	Quantico Creek	Bckgrd	8	0		8	38.1	82.95	75.4	88.1
		MCB	8	0		8	47.7	77.2	70.24	83.3
Cobalt	Quantico Creek	Bckgrd	8	0		8	12.9	29.75	27.38	32.5
		MCB	8	0		8	16.2	28.1	25.79	32.4
Copper	Quantico Creek	Bckgrd	8	0		8	81.1	193	187	254
		MCB	8	0		8	46.1	93.95	120.5	229
Iron	Quantico Creek	Bckgrd	8	0		8	25600	46250	42100	48660
		MCB	8	0		8	23960	43000	38500	45560
Lead	Quantico Creek	Bckgrd	8	0		8	27.7	50.8	48.04	57.8
		MCB	8	0		8	45.9	53.65	61.16	122
Manganese	Quantico Creek	Bckgrd	8	0		8	542	878.5	1040	2030
		MCB	8	0		8	604	972.5	968.4	1210
Mercury	Quantico Creek	Bckgrd	8	0		8	0.0605	0.187	0.1861	0.285
		MCB	8	0		8	0.117	0.2475	0.2357	0.364
Nickel	Quantico Creek	Bckgrd	8	0		8	25.7	55.25	51.46	67.4
		MCB	8	0		8	24.6	50.25	46.39	66.6
Selenium	Quantico Creek	Bckgrd	8	0		8	1.24	3.125	3.334	5.94
		MCB	8	0		8	0.668	0.88	1.42	3.27
Silver	Quantico Creek	Bckgrd	8	0		8	0.26	0.689	0.6482	0.973
		MCB	8	0		8	0.325	0.698	0.6694	1.07
Thallium	Quantico Creek	Bckgrd	8	0		8	0.74	0.9565	1.008	1.35
		MCB	8	0		8	0.565	0.805	0.8239	1.13
Zinc	Quantico Creek	Bckgrd	8	0		8	227	478.5	484.5	732
		MCB	8	0		8	134	331.5	383.6	785

Table 2. Summary of PAH Analyte Concentrations

Analyte	General Area	Area	N	Nondetects		Detects				
				n	DL	n	Min.	Median	Mean	Max.
2-Methylnaphthalene	Quantico Creek	Bckgrd	8			8	4.2	8.245	11.14	24.25
		MCB	8			8	7.54	12.57	19.37	37.46
Acenaphthene	Quantico Creek	Bckgrd	8			8	2.19	2.82	2.93	3.98
		MCB	8			8	1.67	6.135	8.249	24.78
Acenaphthylene	Quantico Creek	Bckgrd	8			8	0.42	0.89	1.506	6.24
		MCB	8			8	0.47	1.435	2.396	5.32
Anthracene	Quantico Creek	Bckgrd	8			8	3.88	6.185	6.5	10.28
		MCB	8			8	2.93	13.31	19.52	40.43
Benzo(a)pyrene	Quantico Creek	Bckgrd	8			8	19.78	32.02	53.07	197.2
		MCB	8			8	13.06	79.84	95.75	247.5
Benzo(b)fluoranthene	Quantico Creek	Bckgrd	8			8	31.43	49.23	68.16	207.2
		MCB	8			8	21.34	116.8	123.1	278.1
Benzo(g,h,i)perylene	Quantico Creek	Bckgrd	8			8	17.73	25.72	37.17	114.3
		MCB	8			8	9.54	63.33	62.13	139.9
Benzo(k)fluoranthene	Quantico Creek	Bckgrd	8			8	26.44	45.84	67.54	228.1
		MCB	8			8	18.81	105.2	116.1	267.8
Chrysene	Quantico Creek	Bckgrd	8			8	35.35	53.34	71.96	200.8
		MCB	8			8	25.67	134.8	155.3	356.5
Dibenzo(a,h)-anthracene	Quantico Creek	Bckgrd	8			8	2.95	4.24	7.721	29.56
		MCB	8			8	1.69	11.74	13.62	36.81
Fluoranthene	Quantico Creek	Bckgrd	8			8	69.15	93.04	106.4	204.5
		MCB	8			8	43.52	237	261.1	554
Fluorene	Quantico Creek	Bckgrd	8			8	5.1	7.52	8.616	13.34
		MCB	8			8	5.85	14.06	18.04	38.25
Indeno(1,2,3-c,d)-pyrene	Quantico Creek	Bckgrd	8			8	15.44	23.48	38.3	133.6
		MCB	8			8	7.9	60.45	62.15	152.1
Naphthalene	Quantico Creek	Bckgrd	8	5	4.79-9.11	3	13.12	13.84	14.95	17.89
		MCB	8	2	7.87-9.94	6	10.62	20.04	24.05	49.1
Phenanthrene	Quantico Creek	Bckgrd	8			8	26.66	31.38	36.33	58.14
		MCB	8			8	17.94	87.66	90.55	203
Pyrene	Quantico Creek	Bckgrd	8			8	59.03	84.16	101.2	220.7
		MCB	8			8	39.4	204	237	525.6

Table 3. Summary of Total PAHs, PCBs, and DDxs

Analyte	General Area Area		N	n	Detects			
					Min.	Median	Mean	Max.
Total PAHs	Quantico Creek	Background	8	8	488.5	882.7	1043	1940
		MCB	8	8	411.5	1529	1800	3478
Total PCBs	Quantico Creek	Background	8	8	8.94	18.75	21.06	35.62
		MCB	8	8	27.84	36.56	39.81	65.16
Total DDx	Quantico Creek	Background	8	8	1.59	3.335	4.56	10.13
		MCB	8	8	6.11	42.3	54.13	161.7

Table 4. Summary of Pesticide Analyte Concentrations

Analyte	General Area Area		N	n	Nondetects DL	Detects				
						n	Min.	Median	Mean	Max.
a-Chlordane	Quantico Creek	Background	8	0		8	0.13	0.305	0.3213	0.53
		MCB	8	0		8	0.21	0.43	0.7313	2.66
g-Chlordane	Quantico Creek	Background	8	7	0.1-0.14	1	0.51	0.51	0.51	0.51
		MCB	8	7	0.08-0.17	1	3.56	3.56	3.56	3.56
gamma-BHC	Quantico Creek	Background	8	5	0.07-0.11	3	0.13	0.16	0.17	0.22
		MCB	8	2	0.07-0.14	6	0.11	0.2	0.1967	0.3
Aldrin	Quantico Creek	Background	8	8	0.07-0.11	0				
		MCB	8	5	0.09-0.13	3	0.19	0.38	0.84	1.95
Dieldrin	Quantico Creek	Background	8	7	0.1-0.17	1	0.33	0.33	0.33	0.33
		MCB	8	3	0.17-0.21	5	0.36	0.79	1.38	4.32

N=total number of samples;

n=number of samples within category of detected concentrations or nondetects

DL=reported detection limits